Glacial Lake Missoula

Missoula, Montana

Glacial Lake Missoula Chapter truly covers the area where the incredible Ice Age Floods began, the entire area of impoundment of the Clark Fork River from just southeast of the ice dam at the furthest extent of the lake, including the waters of the Flathead, Bitterroot, Clearwater, and Blackfoot tributaries.

J.T. Pardee, the geologist who identified the source of the floods that swept down the Columbia, lived in this area. It is also home to David Alt, University of Montana geologist, and others who continue to contribute to our understanding of this cataclysmic event.

The chapter maintains an exhibit in Missoula in cooperation with the Montana Natural History Center, 120 North Higgins Street (call 406-327-0405 for hours) where you can watch videos about the great floods, view artifacts from the life of J.T. Pardee, pick up a map of a driving route of floods features in this area, and find other related books and brochures.

The Glacial Lake Missoula chapter sponsors speakers and field trips several times each year. To contact us, visit Facebook, or the chapter page on the Ice Age Floods Institute website (IAFI.org), or contact the Montana Natural History Center.

FOLLOWING THE PATHWAY

During the last glacial cycle of the Ice Age some 80,000 to 14,000 years ago, repeated ice dam collapses released cataclysmic floods from massive Glacial Lake Missoula, creating many of the distinguishing features of the interior Northwest’s landscape.

This is your guide to the dramatic evidence of these incredible floods, from wave-cut strandlines to spectacular canyons and cliffs to waterfalls and vast, flood-eroded pathways, that can be witnessed in a short road trip.

It is our hope that you will use this guide to explore the fascinating geological flood features in our region, and want to learn more about the dramatic Ice Age Floods story.

THE GREAT FLOODS

The Story of the Great Ice Age Floods

During the peak of the last Ice Age, a vast Cordilleran continental ice sheet covered southwestern Canada and the northern parts of Washington, Idaho and Montana.

An eastern Purcell lobe of the ice sheet descended into the Idaho panhandle, blocking the Clark Fork River with an ice dam thousands of feet thick.

Water rising behind the ice dam flooded the valleys of Montana creating Glacial Lake Missoula—a great inland lake stretching over 200 miles to the east with a volume of water greater than Lake Erie and Lake Ontario combined.

The rising lake waters periodically caused the ice dam to fail, resulting in sudden, cataclysmic floods that rushed across northern Idaho and the Channeled Scablands of eastern and central Washington, through the Columbia River Gorge, and into Oregon’s Willamette Valley, before emptying into the Pacific Ocean at the ancient mouth of the Columbia River.

Glacial Lake Missoula would have drained in just a few days as a volume of floodwaters greater than all the rivers of the world combined roared across the landscape at up to 60+ mph.

Now imagine this happening not once but dozens, perhaps even hundreds of times as the advancing continental glacier rebuilt new ice dams.

Interesting Flood Facts!

Glacial Lake Missoula filled from a combination of rainfall, meltwater draining south from the continental ice sheet and from drainage of alpine snow from surrounding mountains.

Because of repeated flood cycles and harsh conditions, there were no fish in this lake nor many mammals in the valleys. Soils left behind were poor and vegetation sparse.

The underlying rock in most of this region is very hard, erosion-resistant metamorphic rock with distinctive minerals.

Flathead Lake was gouged out by a lobe of the continental ice sheet and today is the largest lake in the US west of the Great Lakes.

Glacial Lake Missoula contained over 500 cubic miles of water and ice. The lake covered 3000 sq mi, and was up to 2000 feet deep. It was 16 times the size of Flathead Lake and at Missoula it was 6 times Flathead Lake’s average depth.

The period between Ice Age Floods in this area ranged from 58 years to as little as 9 years.

The roar of a coming flood could have been heard at least ½ hour before it struck.

J Harlan Bretz, originally a Seattle school teacher, first presented his theory of the floods in 1923, and J.T. Pardee, a USGS geologist working near Missoula, published his findings on a glacial lake in 1942, but there was not general acceptance of the idea until the 1970s.

No human relics have been found yet in the floods areas, but natural history suggests there possibly were witnesses to these events.

Ice Age Floods National Geologic Trail

Since the 1980’s the Ice Age Floods Institute (IAFI) has worked to create and to build support for the Ice Age Floods National Geologic Trail.

The Ice Age Floods National Geologic Trail is essentially a network of marked touring routes extending across parts of Montana, Idaho, Washington, and Oregon, with several special interpretive centers located across the region. Many interested parties are being brought together in a collaborative and effective interpretive program at a remarkably low cost, despite the extraordinary size of the region. The Trail is being developed under the National Park Service on existing public lands, with no changes in jurisdiction and no threats to private property rights. The role of the National Park Service is to coordinate and manage the planning of the project and the telling of the story, without taking custodianship of public and private lands.
Glacial Erratic
Location on the Main Oval, University of Montana campus

As ice-age glaciers moved through the landscape they picked up large boulders which became embedded in the ice. These boulders were rafted in chunks of ice in glacial lakes or sheetfloods, then deposited as the waters receded and the ice melted. Smirnoff such as the one the UM campus can be found throughout Missoula neighborhoods and cutting the hillsides.

Rainbow ‘Dog’ Lake
Directions: Continue on MT 200, turn north on Hwy 282 at Plains, travel 2 miles to the end of the road for an open view from the highway.

Rainbow Lake is now thought to be a cataract retreat lake, formed by the erosion and upland retreat of a 100 ft. waterfall. As the level of the ice-age floodwaters along the Clark Fork River dropped over 1.2 ft. near the present town of Plains, the sudden change in elevationcreated flows of up to 70-90 mph through the Royal Creek spillway. Any weak spots in the eroding rock were a source of more erosion. The recirculation current created in the plunge pool of the waterfall continually undermined the lip of the waterfall, causing the lip to collapse and the waterfall to reflood upstream. As this process repeated with each flood the deep Rainbow “Dog” Lake was left behind, marvling the entire migration path of the retreating water and plunge pool. The debris from this erosive action was dumped in the valley downstream.

Markle Pass Kolkos
Directions: Continue on Hwy 282, then Hwy 382 for 8 miles to a pull off at the top of the pass.

In areas adjacent to the road there are deep rocky holles and circular ponds, called kolkos, that are carved out of the bedrock by intense underground water in the formation that acts as an underground whirlpool or "tornado." The vortices are caused by water seeping in intense, light circular motions in areas where the water flow is restricted. When these vortices extend to the bed of the river they can produce turbulence of the underlying surface by the water's sudden friction with the bedrock and the bunding suction action of gas bubbles. Numerous kolkos are found in the passes near Camas Prairie including Surprise Lake. The churchs of rock pilings cut out of a rock are transported and deposited downstream.

Glacial Lake Missoula High Water Markers
Since 2010, The Glacial Lake Missoula Chapter of the Ice Age Floods Project has installed several engraved stone monuments near popular hiking trails and attractions. These monuments are placed at 430.0 ft. elevation, approximately the high water mark of Glacial Lake Missoula at capacity. To date, you can discover these markers at "last, long.”

Mt. Jumbo - on the the Long Trail above the "M" (46.85825°, -113.977187) and on the Pelly Ridge Trail from the gravel of trailhead in Pattee Canyon (46.83975°, -113.977128)

Mt. Jumbo - on the the Bearclaw Trail from the Lincoln Hills Trailhead (46.88596°, -113.849933) and on the "L" Trail above the "L" (46.87041°, -113.960592)

Lake Como - east of the swimming area parking (46.88522°, -114.238421). It marks the furthest extent of Glacial Lake Missoula.

Canyon Creek - 50 pull-offs about 60 miles west of Missoula are planned to have high water markers by 2020.

Eddy Narrows
The walls of this narrow, 10 mile long canyon are bare of trees and washes up to the level estimated to be the highest level of the lake (1020 ft). There are large groves of bigtoothed aspens 340-400 feet above the Clark Fork River that run parallel to it. Since there is no evidence of glaciation in this area, the only explanation is the rapid draining of Glacial Lake Missoula. In 1942, J. T. Pettine was able to calculate the speed and volume of water which could flow through this restricted channel.

Follow Hwy 202 past where Arvon Creek intersects the Highway. 16 miles west of Plains, a Forest Service trailhead marks a good starting point.

St. Regis Knob
A scenic pull-out in the bedrock north of St. Regis marks a channel cut where the flood waters rushing down the Clark Fork River divided into two branches which ran right to the north where it meets the St. Regis River and were forced back over the adjacent hills. Located at Exit 33 from interstate 90.

Ninepipes Pingo Scars
Pingo scars found in this area are places where permafrost ice formation occurred. Sometimes called "potholes," these holes are the result of multiple cycles resulting in the formation of small round depressions bordered with a rim and hummocks. A natural wild rice refuge and a local museum are also located in this area.

Located on Hwy 212 west of the intersection with US 93.

Paradise Boats
Boat exhibit which includes an interactive topographic relief model of the entire Rainier Lake Missoula area in Montana.

Two runs off MT 200 in Paradise, on 1st Street. Go 4 blocks and turn right onto North Avenue and continue south to the boat dock. Call 406-258-0060 for hours.

National Bison Range
This area was set aside for the preservation of bison in 1905 and remains largely undisturbed prairie. There are several eras and strandlines visible near the Bison Canyons and there is an interpretive sign near the summit. The Mission Mountains across the valley were sculpted by glacial processes above the highest level of Glacial Lake Missoula. There is a visitor center with some ice age flood materials. Take US 93 from Missoula to MT 308. Turn south at the canyon overpass and travel about 4 miles to the entrance. For hours call 406-544-2511.

Sloan Bridge Sediments
The white bluffs to the north record the sedimentation at the bottom of Lake Missoula. The continental ice sheet was only 18 miles away and this is the next weathering off the ice, making the lake near the ice this color. There are no gaps or soil horizons to indicate much time passing between filling of the lake in the waning stages of the ice age.

Located where a partially flooded road between Hwy 362 and US 93 crosses the Flathead River, take 217 North Battle Hill to the Early Quven north of Ronan.